Fort Huachuca, Ariz.

Book No. 1 A

Index

I N D E X

COMPLETION REPORT - NEW WELL

FORT HUACHUCA, ARIZONA

OFFICE OF THE CONSTRUCTING QUARTERMASTER

FORT HUACHUCA, ARIZONA.

March 9, 1939.

SUBJECT: Completion Report of New Well #4; portion of O.P. 752-13-1.

TO: Quartermaster General, Washington, D.C.

(1) General - The project consists of drilling, casing, perforating and testing New Well in the immediate vicinity of the East gate of the Military Reservation, Fort Huachuca. The purpose being to increase water supply to meet the needs of the Post by augmenting the present supply, which for several years has been restricted due to periodic annual shortages. The well was dug to a depth of 701 feet and cased with 14" OD Casing. Perforations were made in approximately 200 feet of the casing to permit the inflow of water from the water bearing gravel. The water level was fixed at 460 feet below the surface of the ground which level had risen approximately 10 feet above the water gravel. The work was done entirely by Contract and constitutes one item of the proposed improvements to the Water Supply System as set up in letter of July 19, 1938, file No. QM 671 CN-E, Official Project No. 752-13-1.

(2) Description of Completed Project -

(a) General Statement as follows:
2. Utilities -

(b) Water System -

Steel Casing 3/8" thick, 14" outside diameter, 703 feet in length lowered, anchored and perforated for 200 feet through water bearing gravel.

3. New Well drilled, cased and perforated to supply additional water service for the benifit of the Government and the 25th Infantry at present stationed at Fort Huachuca, Arizona.

4. The construction of this well was accomplished for the purpose of obtaining more water to eliminate restrictions and guarantee a sufficient quantity of water for sprinkling of lawns, irrigation of shrubbery, fire protection and other necessary uses.

Completion Report,
Cont'd.

5. The land on which the well is drilled is on the Military Reservation and is owned by the Federal Government. No easements nor licenses are involved.

(b) The well is located near the East gate of the Military Reservation at Fort Huachuca, Arizona. Reference is made to Reservation Map, drawing No. 6203-100.

(c) No equipment is installed on which name plates would be necessary.

(d) Photographs -
Reference is made to photographs, with titles noted on each, as submitted with Narrative Reports during construction of well. The numbers of these photographs being as follows: 1650, 1662, 1672, 1673, 1696, 1709, 1731, 1737, 1764, 1765, 1766, 1767, 1768, 1769, 1770, 1771, 1772, 1773, 1774, 1775. Further reference is made to photographs No's 1800 to 1820 inclusive, and No. 1832 submitted with the accompanying report of Testing 14-Inch Well. Of these photographs No's 1808, 1809, 1810, 1811, 1813 and 1814 show water being discharged from the discharge pipe and authenticates the completion of the well.

(e) Soil data -
The soil at this location is hard compact gravel and silt. It's bearing value is 5000 pounds per square foot.

(f) Plans -
Reference is made to accompanying drawings as follows:
No. 6203-1025A; showing data.
No. 6203-1025B; showing a graph of well.
No. 6203-1025C; showing log of well and definite location.
No. 6203-1025D; showing orifice chart.

(g) Character of contract does not require guarantee as to maintenance of work.

(3) Construction data -

(a) General Conditions -
The contractor, W.E. Lane, of Bisbee, Arizona, received his notice to proceed with the drilling of the well on November 23, 1938 and by December 5, 1938, had transported his drilling rig to the location of the new well and constructed a shelter to protect the workmen while drilling operations were in progress and on that date started the actual drilling of the 14" drill hole. On January 3, 1939, at a depth of 470 feet water bearing gravel was encountered and continued without interception until

(3) Construction data - (Cont'd.)

(a) General Conditions - (Cont'd.)

January 25th when a depth of 680 feet was obtained. At this point adobe was encountered for a depth of 12 feet, after which the drilling became very hard and was apparantly in hard rock. At a depth of 701 feet from the surface of the ground drilling operations were suspended. This date being January 27, 1939. Immediately, the operations for lowering, anchoring and perforating the 14" OD Casing was effected and completion of this phase of the work was accomplished by February 19th when insertion of the pump column into the 14" casing was started. After the pumping equipment and power units were completely installed for testing purposes the actual testing of the well for water quantities was started on February 22, 1939. Due to a mechanical breakdown of the 400 H.P. Gasoline Engine originally installed as a power unit to propell the Wintroath 12" Turbine Type, 22 Stage, Pump, the completion of the test was delayed until electric power could be connected from the new 6600 volt transmission line to energize a 2300 volt, 150 H.P. Induction Type Motor, The test was completed on March 1, 1939 the result of which exceeded the anticipated requirements. There were no change of conditions effecting operations.

(b) Operations by Contractor -

1. Organization:
The Contractor, W.E. Lane, of Bisbee, operates as an individual expert well driller.

2. His methods and equipment are modern and efficient, the material supplied by him was up to specifications in every respect and labor used was competent.

3. The only difficulty encountered, with the exception of boulders which at times slowed up the drilling operations, was the interuption during the testing period caused by the breakdown of the 400 H.P. gasoline engine. The solution there of was accompolished by completing the electric circuit from the new 6600 volt transmission line to the location of the well and the subsequent installation of the 150 H.P. Induction Type Motor as a prime mover in place of the gasoline engine.

4. The contractor demonstrated outstanding ability and experience in the line of work called for by this contract and executed the completion of this project to the satisfaction of all concerned. He bears an excellent reputation as an expert well driller and payment of obligations for material and labor were promptly accompolished.

Completion Report,
Cont'd.)

(c) Progress -
Reference is made to drawing No. 6203-10250.

(d) Supervision of the work was conducted by the Constructing Quartermaster, the contractor in person, two Civil Service engineers, and one assistant Inspector.

(4) Financial Data -

(a) List of Appropriations involved:
(PWA QM); 0581, 1938-1940, 21-408/00581 QM 3601 P1-3211 A0581-80, O.P. 752-13-1.

(b) Name and Address of Contractor:
William Ernest Lane, Box 333, Bisbee, Arizona.

Date and Amount of Original Contract:

Date	No.	Amount
November 23, 1938	ER W6203 QM 25	$8455.00

List of Change Orders:

None

(c) (1) Total Cost of Work: $8455.00

(2) Cost of Various Items entering into the work:

Labor:
Contractor's employees $ 605.00

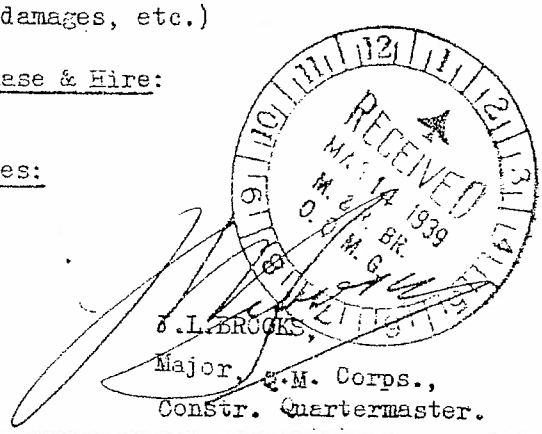
Material:
703 ft of 14" OD Casing and Drive Shoe $2586.82

Other Items:
Perforating, Testing and Miscellaneous $5283.18

(3) Amount of Contracts: $8455.00
(Note: No reductions made because of penalties, liquidated damages, etc.)

(4) Expenditures under Purchase & Hire:
None

(5) Overhead and Other Charges:
None



O.L.BROOKS,
Major, Q.M. Corps.,
Constr. Quartermaster.

OFFICE OF THE CONSTRUCTING QUARTERMASTER
Fort Huachuca, Arizona

March 7, 1938

TESTING 14-INCH WELL

P.W.A. Official Project 752-16-1

Plans and Title
69-3-1073X
" 1074X
" 5-14

Compiled under the supervision of

JOSEPH L. BROOKS
Major, Q. M. C.
Constructing Quartermaster

OFFICE OF THE SUPERINTENDENT, [illegible]
Fort Huachuca, Arizona

March 7, 1888

[illegible] 14-INCH WELL

The drilling operations conducted near the east gate of the Reservation for developing a 14-inch well were completed about the middle of the month of February, at which time, all casing had been lowered into the drill hole and had been anchored to what appeared to be rock at the bottom of the hole at a depth of seven hundred and one (701) feet.

The perforations in the casing started at a point twenty feet above the bottom of the hole. The perforations were made in the manner shown on drawing No. 8303-10x5A for a distance from this point to an elevation ten feet below the point in the well at which the water bearing strata was penetrated. The top of the casing was anchored at the surface of the ground in a manner which permitted the casing to extend thirty inches above the average ground level at that point.

In the meantime, the contractor was pressing his demand for the delivery of a pump of proper design and suitable size to lift the water from a level established at approximately five hundred and eighty (580) feet below the top of the casing to a discharge pipe located about three feet above the surface of the ground.

The drilling contractor encountered some difficulty in getting his equipment delivered on time, and, as a result, he exceeded the time limit of his contract by several days before his equipment was delivered. The delivery of the necessary shafting, bearings, and pump bowls was made about the 18th of February, and the contractor began assembling this material for lowering into the well casing as soon as it arrived. The first unit to start down was a strainer made of brass and approximately two feet in length. To this strainer was added ten feet of eight inch suction pipe, and above that was connected the twenty-two units or bowls comprising the pump section of the turbine which he proposed to use in getting the required amount of water out of the well. From that point, successive units of combined pump column, shafting, bearings, and oil pipe were added. The lowering of each section taking place as quickly as the assembly could be made. Adjacent to the pipe used for oil circulation was placed the pipe of smaller size to be used for making tests of water level as its elevation should rise or fall with the eduction of

the water. These two smaller pipes were attached by heavy number nine annealed wire to the eight inch pump column as each section was assembled.

When finally completed, this pump assembly was set so that the lower bowl was five hundred and eighty (580) feet below the top of the fourteen inch casing. The end of the quarter inch air pipe was located at exactly the same elevation. A determination of the elevation of the surface of the water with an electrical device indicated that the static water level was located one hundred and seventeen (117) feet above this point, making a head of one hundred and seventeen (117) feet over the last bowl of the pump unit. About the end of the month, the four hundred (400) H.P. gasoline engine was delivered by the trucking company engaged to transport this engine from the coast to the location of the well. This engine was immediately placed in position so that the pulley operated by the engine was in line with the pulley on the head of the discharge column through which the steel shafting extending from the surface of the ground to the bowl mechanism for rotating the impellers of the twenty-two bowls installed in series.

With the setting of this engine, the installation of which was complete about nine o'clock in the evening, the contractor was instructed to start operations at once following the outline given in his contract for the initial eduction of water from the well. These instructions read that the pump should be operated intermittently with frequent starts and stops to permit the rearrangement in and around the holes perforated in the pipe of the pebbles from the water bearing gravel, the intent being to jiggle these pebbles in a manner which would relocate them in position to form a screen which would prevent entrance of the finer particles of sand from the water bearing gravel into the casing, and therefore into the pump.

This type of operation was conducted for a period of two hours, stopping finally about eleven P.M., and from which the following facts were developed, these being further evidenced by the tabulations of results on print number 3.08-1085 which accompanies this report. It is interesting to note that each time pumping operations were stopped, the water level returned from the draw-down elevation to the static elevation in five minutes. The important development of this preliminary set of operations was the fact that very little sand was ejected from the well and that a production of six hundred and twenty (620) gallons per minute created a draw-down of no more than twenty-nine and one-half (29½) feet below the static water level.

These determinations were made, as far as draw-down was concerned, by pumping the draw-down pipe to the top limit and allowing it to register the actual recession of the water as marked on the gage in feet.

For the determination of the gallons per minute, two measuring devices were used, the first of these was an orifice of exactly six inches in diameter inserted in the end of the discharge pipe. Connected with this orifice was a rubber tube set down in the discharge pipe about four feet behind the orifice and located in the direct center of the eight inch pipe. This tube terminated in a glass tube with graduations, the zero point being set at a fixed distance above the center of the discharge pipe. From this tube inches of head above the center of the orifice were measured and the discharge determined from a curve with to divide along the horizontal axis indicating the exact number of gallons for each inch of head. This measuring device is shown in photograph 1497 being the one pictured on the left side of the doorway in the center of the picture. For the other measuring system, a pair of pitot tubes were used, set in the discharge pipe at a fixed distance from the rear of the orifice and connected by rubber tubes, as shown in picture 1498, to the gage mounted on the right side of the opening in the center of these pictures.

Beginning at midnight, the pump was operated continuously for four hours or until 4:30 a.m. For this four-hour period, the results tabulated on the enclosed sheet will indicate that there were produced six hundred and forty (640) gallons per minute with an accompanying draw-down of thirty-one feet below static water level. The H.P. of the engine for this period averaged twelve hundred (1200).

The next day, during some preliminary tests on the engine and pump, the contractor found a number of parts on his engine to be defective, and, in spite of the immediate repairs on these individual pieces of mechanism, the engine finally became totally disabled, and some other means of motive power had to be provided. The contractor went into Bisbee and, from the local copper company operating there, he obtained an electric motor, induction type, with windings for twenty three hundred (2300) volts alternating current. Five days after the completion of the first test and along about midnight of February 4th, this electric motor with a twenty-eight inch pulley was put into service by making connections to it from transformers terminating the 2300 volt line. The electrical connections were made in a manner to offer as much protection against contacts with this high voltage as possible. The area around the motor was roped off to prevent individuals coming in contact with the pump, the belt, or the motor.

As soon as the electrical connections were completed, the electrical switches were thrown in and the pump started to within it for the third test period of four hours. During this period the accompanying tabulation and graphs will show an average output of seven hundred and ten (710) gallons per minute with the pump rotating at twelve hundred and forty-two (1242) R.P.M. and with the draw-down of approximately thirty-four feet. A rough measurement taken with a portable meter of the quantity of electricity used indicated an approximate electrical input of one hundred (100) H.P. At

four-thirty A.M. the power was shut off and in five minutes the draw-down gage indicated that the water in the well had come up to the normal water level as determined in previous tests.

Since the quantity of power used was more than was available at the power plant during the day-time period, it was necessary to post-pone the next test until after midnight of the following day. Commencing at twelve-fifteen A.M., March 1st, and running through the four-hour period until four-fifteen A.M., it was developed that seven hundred ten (710) gallons per minute could be produced with a draw-down of thirty-four and one-half feet and with the rotation of the pump shaft timed at about twelve hundred and forty-two (1242) R.P.M. These results are also made evident from the tabulations and graphs on the blue print previously referred to.

In order to determine what further quantity of water might be produced while this equipment was set up in operating condition, the twenty-eight inch pulley was removed from the motor shaft and in its place was substituted a thirty-two inch pulley, the belt previously used being put in position over the new pulley by adjusting slightly the location of the motor without disturbing any of the electrical connections. At four-thirty A.M., March 1st, the power was again turned on and it was demonstrated that eight hundred and seventy-five (875) gallons per minute could be produced with a forty-six foot draw-down, the rotation of the pump shaft increasing to an average of thirteen hundred and ninety-four (1394) R.P.M. Under these conditions a second rough measurement of power used during this period indicated that one hundred and forty (140) H.P. had been input. This test was stopped because of the fact that the Post demand for electric power was becoming great enough to over-load the generators at the power plant should this test be continued; therefore, in order not to disturb the electric service at the Post, the test work was discontinued and a report made to the Office of The Quartermaster General of what had been accomplished. When the test was stopped, the water again rose in five minutes to the static water level established at four hundred and sixty-three (463) feet below the collar of the fourteen-inch casing, or one hundred and seventeen (117) feet above the bottom bowl.

The results of these tests indicate very clearly that the draw-down was the result of the actual amount of restriction offered by the perforations in the pipe in regulating the flow from the water bearing gravel into the interior of the pipe. The draw-down evidently uncovered just exactly the required amount of opening in these perforations to deliver the necessary quantity of water to the pump as the pump increased the discharge from the well. This fact is further made evident by the rapid manner in which the water rose from the various draw-down levels to the static water level in just about the necessary amount of time to refill the pipe from those perforated openings. It is quite evident that the

level of the reservoir of water outside of the pipe was scarcely altered in any degree whatever by these operations. It is further evident that a greater quantity of water could have been pumped from this well, should it be necessary, by increasing the number of perforations which were made on the basis that no greater quantity of water than five hundred (500) gallons per minute would be demanded by the Office of The Quartermaster General. In order to make these operations more clearly evident, there have been enclosed a number of photographs showing the character of this temporary set-up for testing the quantity of water in the well, and covering such subjects as the installation of the motor and the gasoline engine, and of the instruments set up for measuring the quantity of water by the two methods (that is, the orifice and the pitot tube). In several of the pictures, the water is shown flowing from the discharge pipe in a full stream, issuing with a velocity of about five feet per second for the seven hundred gallons per minute rate, and flowing off in the drainage ditch provided for the disposal of this water.

At present, all work at the well site has been discontinued awaiting further action by the Office of The Quartermaster General in the matter of purchasing a turbine pump and of a booster pump to handle this water from the well site to the reservoirs. As soon as specifications are written for these two pumps, the construction work at the well site will have been advanced to the point where both pumping units may be tested immediately to demonstrate the ability of each unit to perform its expected duty.

J. E. Moore
Major, Q.M.C.
Constructing Quartermaster

hs

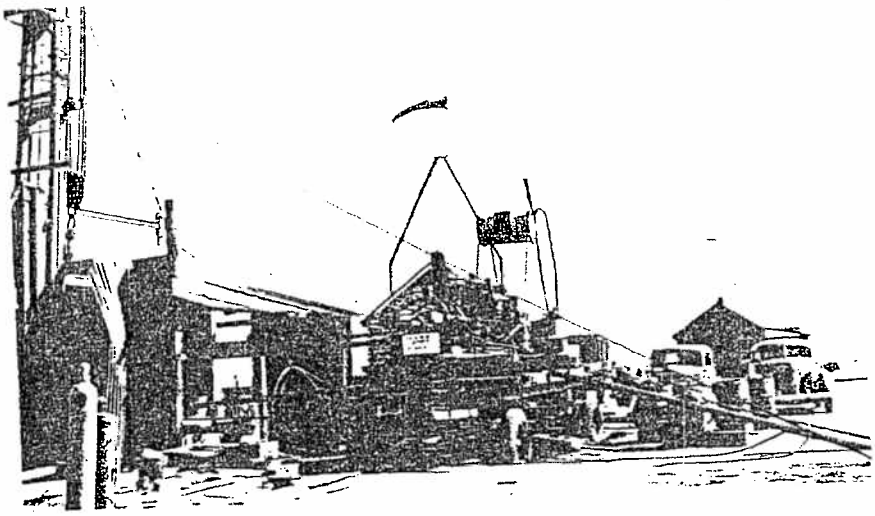
- Print No. 6203-1025A
  6203-1026A
  6203-1025C
  Photographs

ARIZONA

TESTING 14-INCH WELL

February 22, 1939

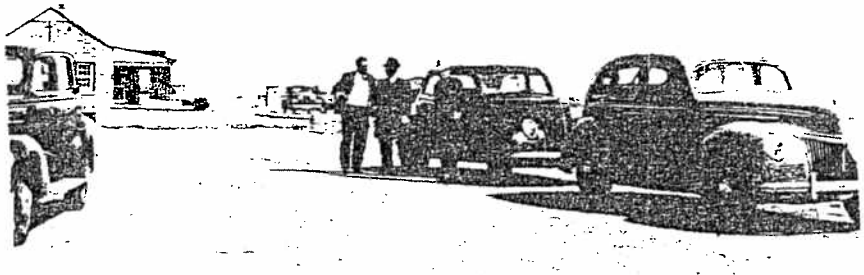
Film No. 1500



View of 400 H.P. gasoline engine mounted on truck ready to operate turbine belt driven pump in well.

February 28, 1939

Film No. 1501

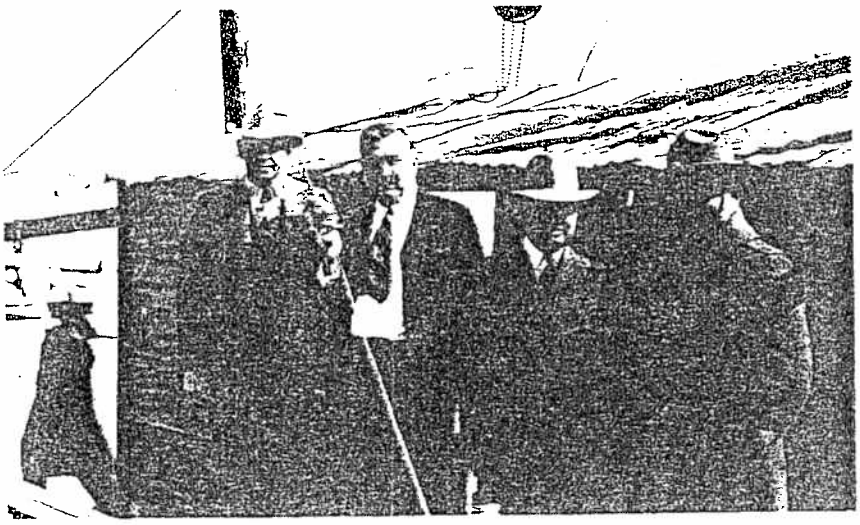


Arrival of guests from Bisbee to witness pumping operations.

FORT HUACHUCA
ARIZONA

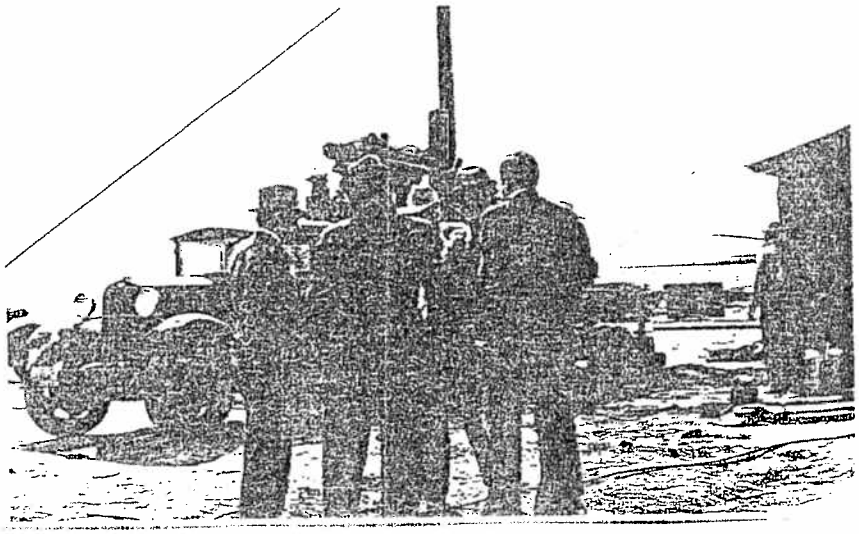
TESTING 14-INCH GUN

Film No. 1402 February 28, 1939



Contractor Lane, Secretary Michaels, President Woods of the Chamber of Commerce with Major Brooks.

Film No. 1403 February 28, 1939



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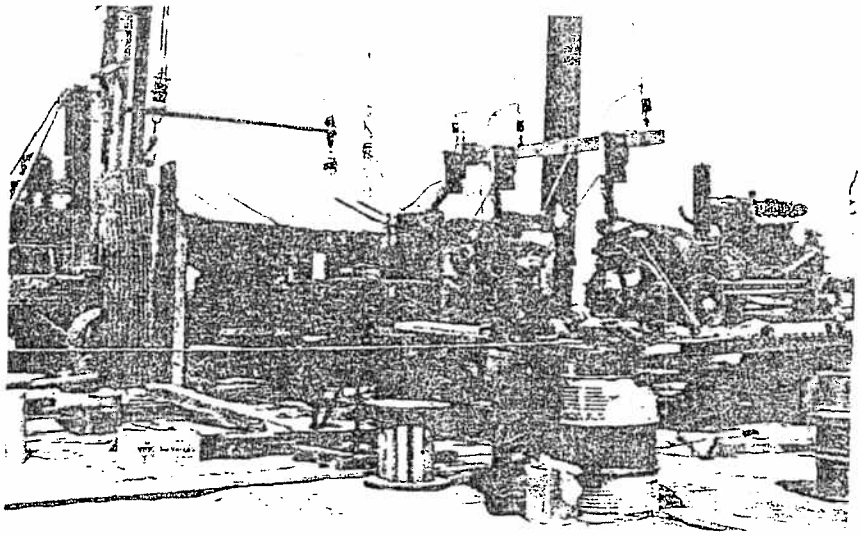
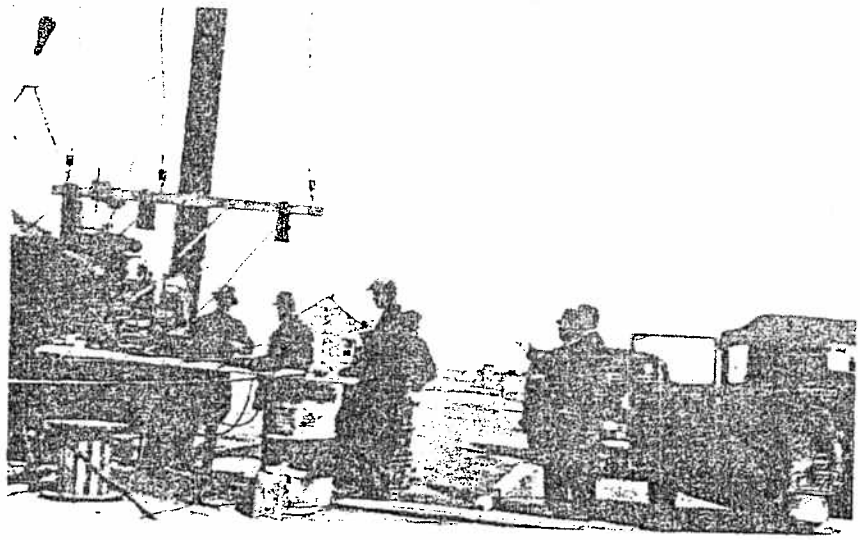
Film No. 1804 February [illegible], 1939



Chief Electrician testing connection between motor and transmission line.

Film No. 1805 February 28, 1939



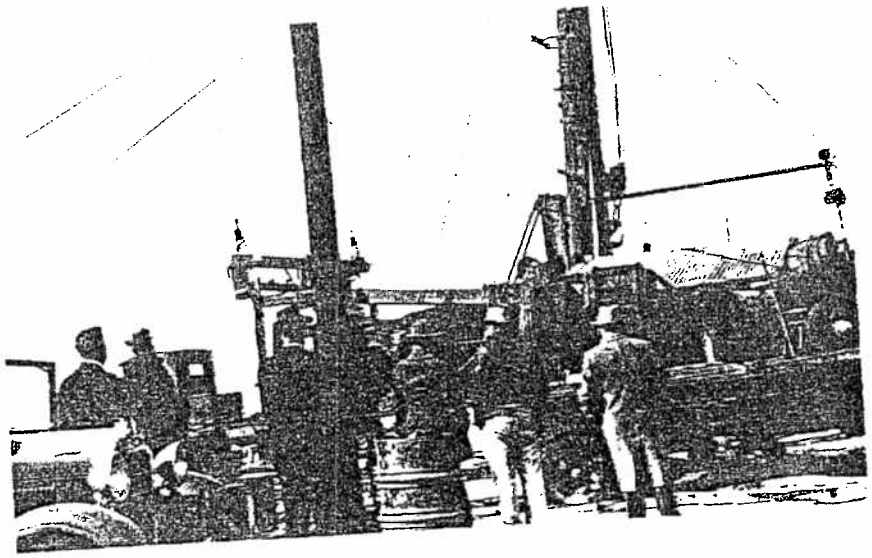
Major Brooks checks final connections before starting test by motor drive.

POLE [illegible]
ARIZONA

TESTING 14-INCH [illegible]

February 28, 1939

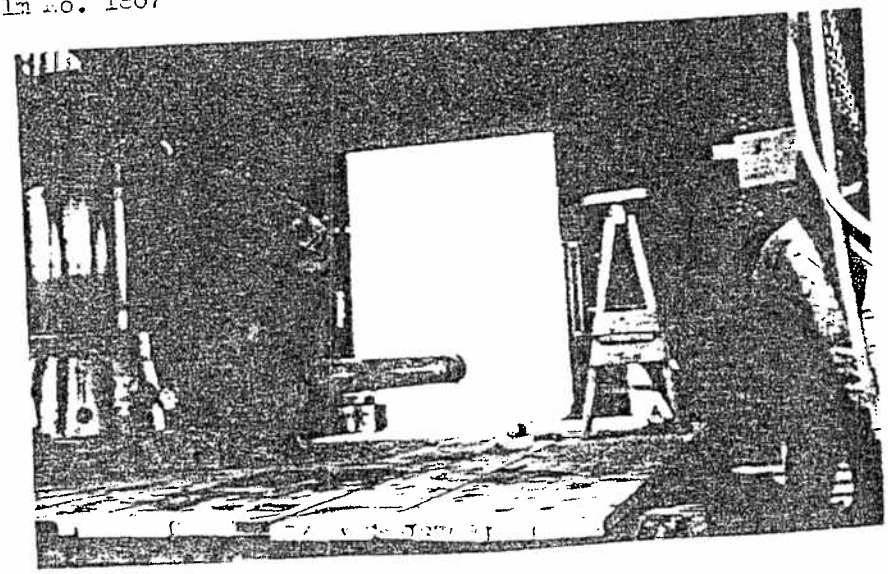
Film No. 1806



Visitors watching start of motor drive for pump test.

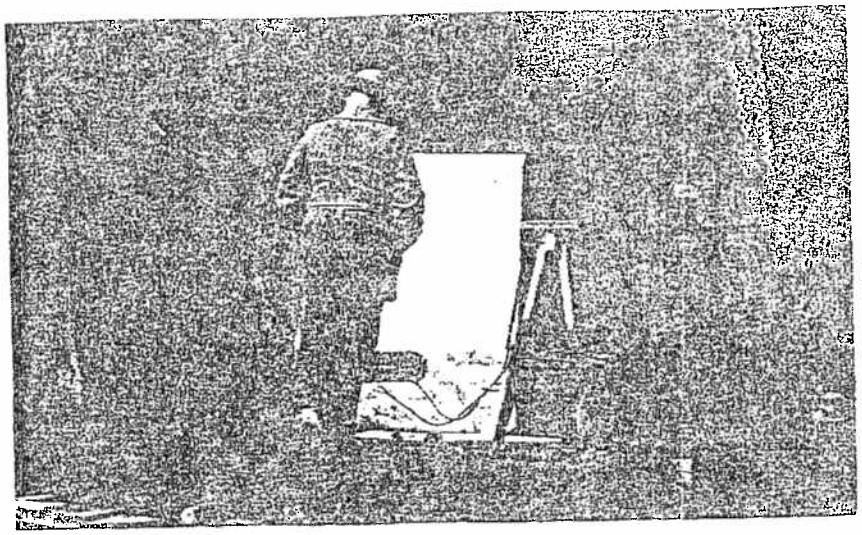
February 28, 1939

Film No. 1807



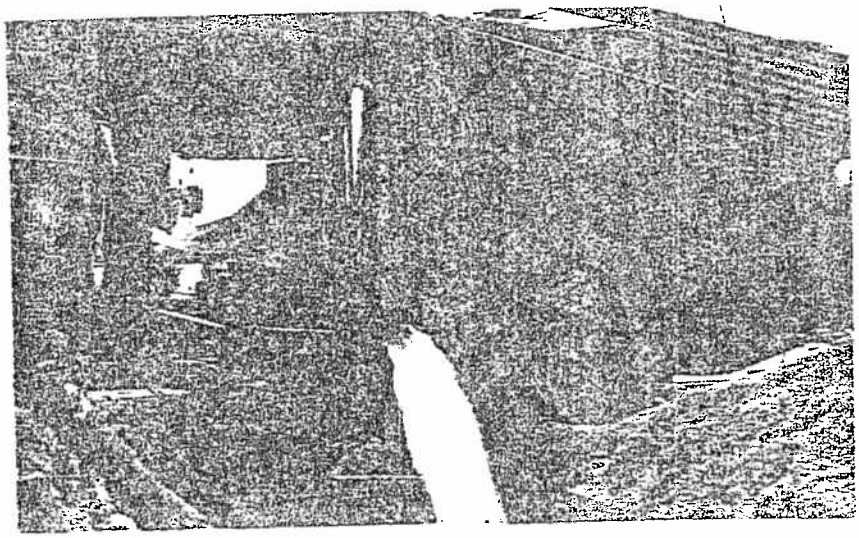
[illegible] termination

Film No. 1608 February 28, 1939



Three minutes after start of motor, water is discharged from end of eduction pipe.

Film No. 1609 February 28, 1939

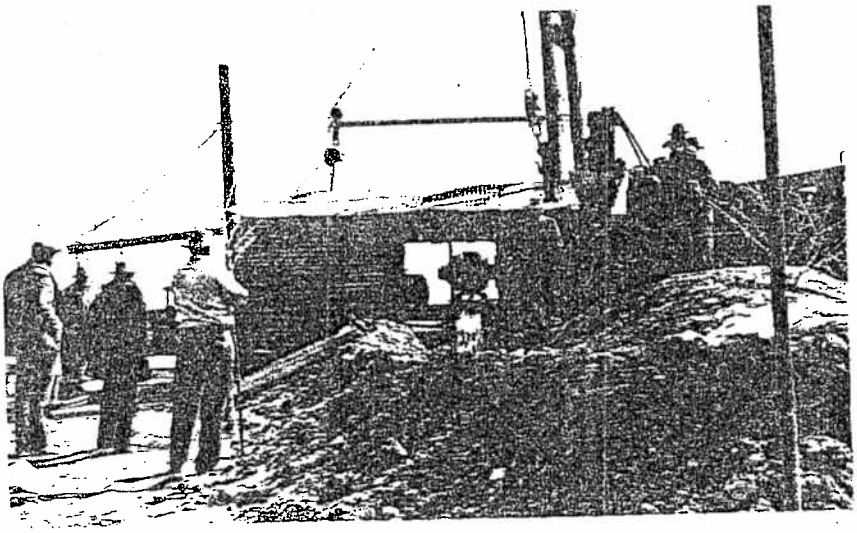


View of discharge pipe, pump head and driving belt.

FORT YUKON
ALASKA

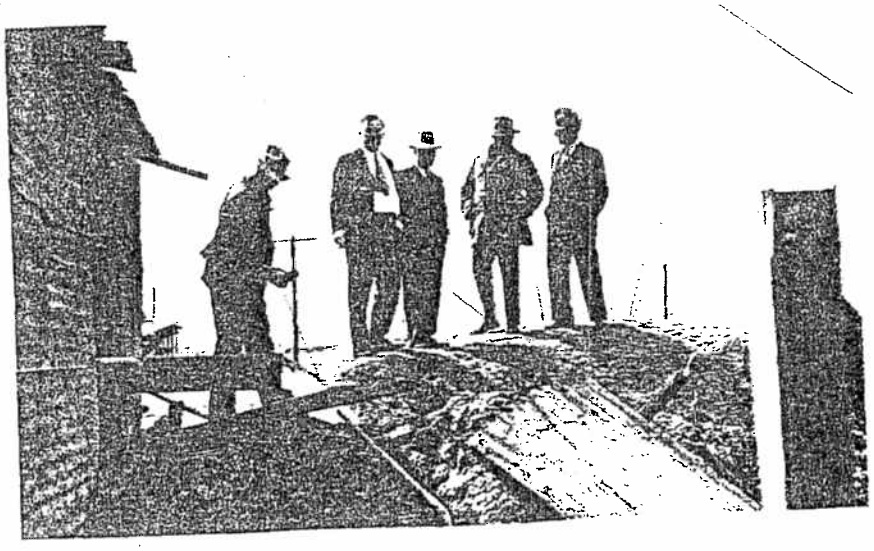
TESTING 14-INCH WELL

Film No. 1810 February 28, 1939



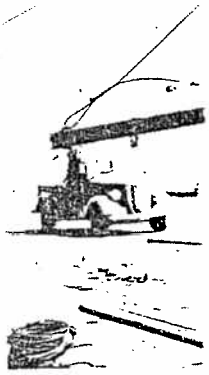
Visitors viewing stream of water discharged into diverting ditch.

Film No. 1811 February 28, 1939



The Associated Press representative asks the contractor some questions about quantity.

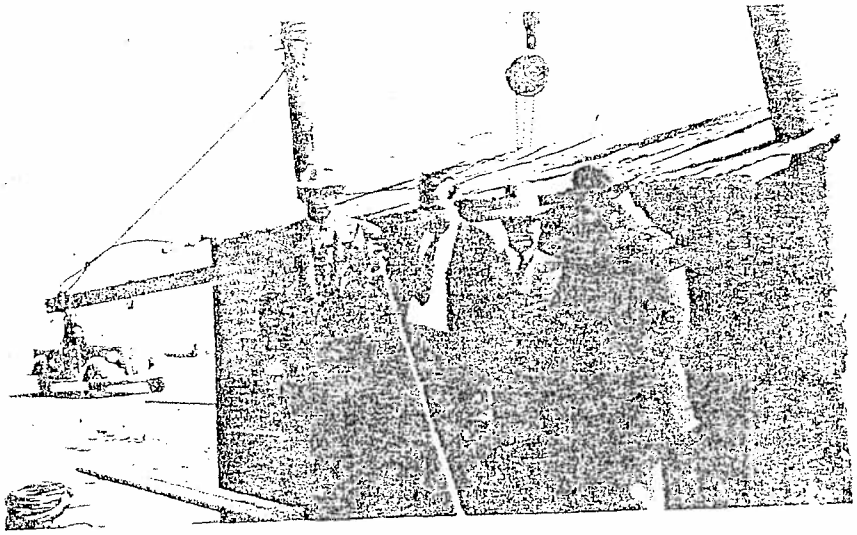
Film No. 1812



The Secretar
observe th

Film No. 1813

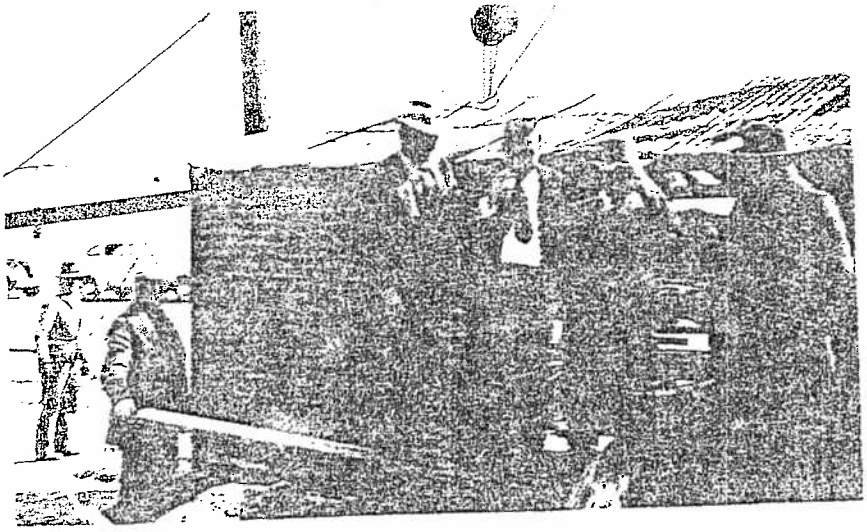
The Press
be plac



The Secretary and President of the Chamber of Commerce observe the flow of water from the discharge pipe.

Film No. 1s13

February 28, 1939



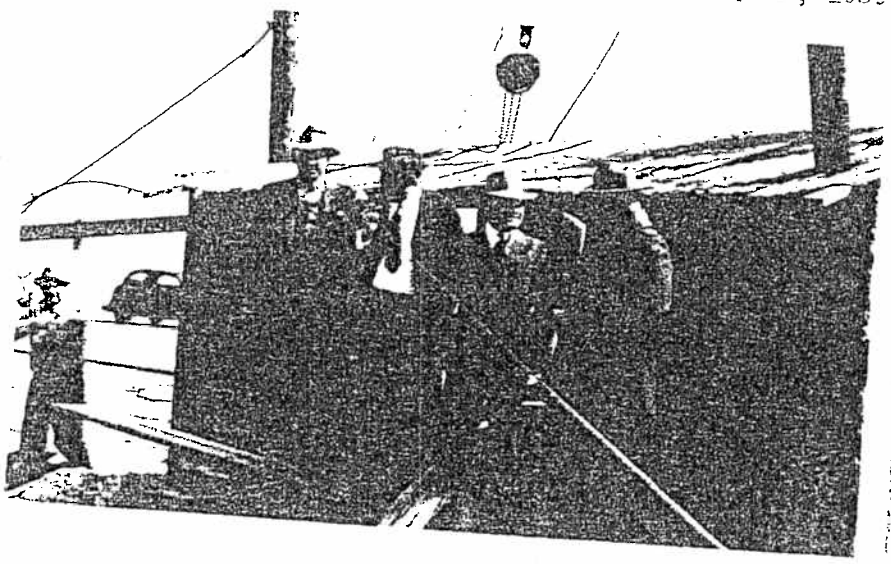
The President of the Chamber of Commerce appears to be pleased with the quantity of water discharged.

FORT HUACHUCA
ARIZONA

TESTING 14-INCH WELL

Film No. 1814

February 28, 1939



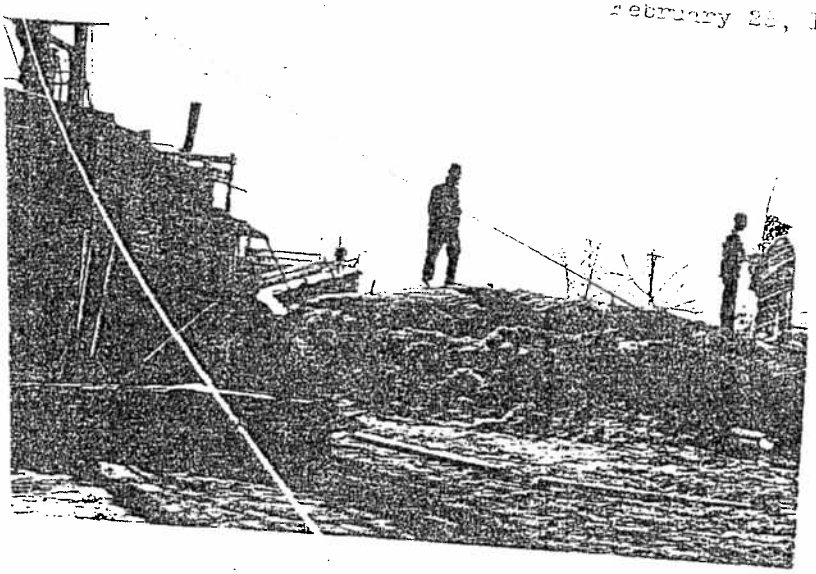
The representative of the pump company (left) also appears to be pleased.

Film No. 1815

February 28, 1939

The representative of the Crane Company talking to [illegible]

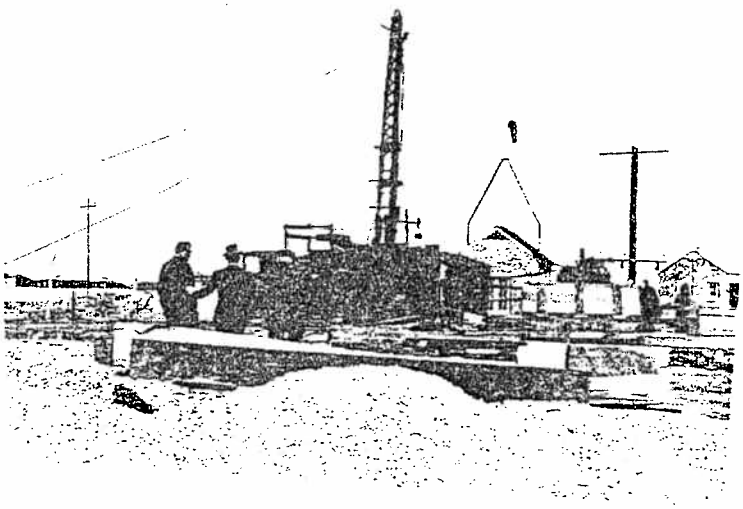
February 28, 1939



flowing from discharge pipe into the diverting ditch.

. 1817

February 28, 1939



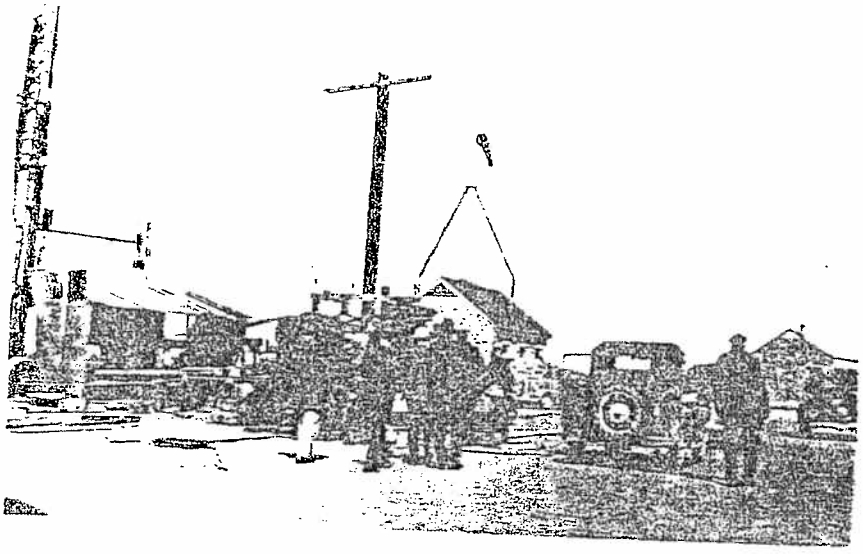
lowing the well testing equipment from the site of the 50,000 Gallon surge tank.

FORT PECK
MONTANA

PUBLIC WORKS ADMINISTRATION

Film No. 1613

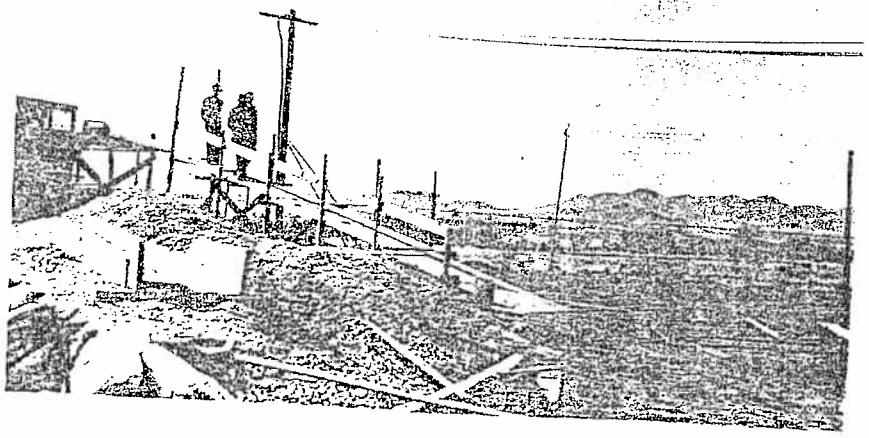
February 23, 1939



Visitors leaving after completion of well-test operations.

Film No. 1619

February 23, 1939



Visitors inspecting work on surge tank adjacent to well site.